

# Society and the Built Environment

## What Lies Ahead?

G. Wayne Clough

President, Georgia Institute of Technology

Vecellio Distinguished Lecture

Virginia Polytechnic Institute & State University

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**Today's challenges  
require civil engineering  
and construction talent.**





A photograph of the Golden Gate Bridge in San Francisco, California. The bridge is a suspension bridge with two large orange-red towers. The bridge spans across a body of water, with hills in the background. A small white sailboat is visible in the water in the foreground.

# U.S. Construction Industry

656,450 firms

5.7 million employees

\$860 billion in 2001

# Virginia Construction Industry

19,537 firms

180,000 employees

\$23.2 billion a year





# The Growing Challenges

## More...

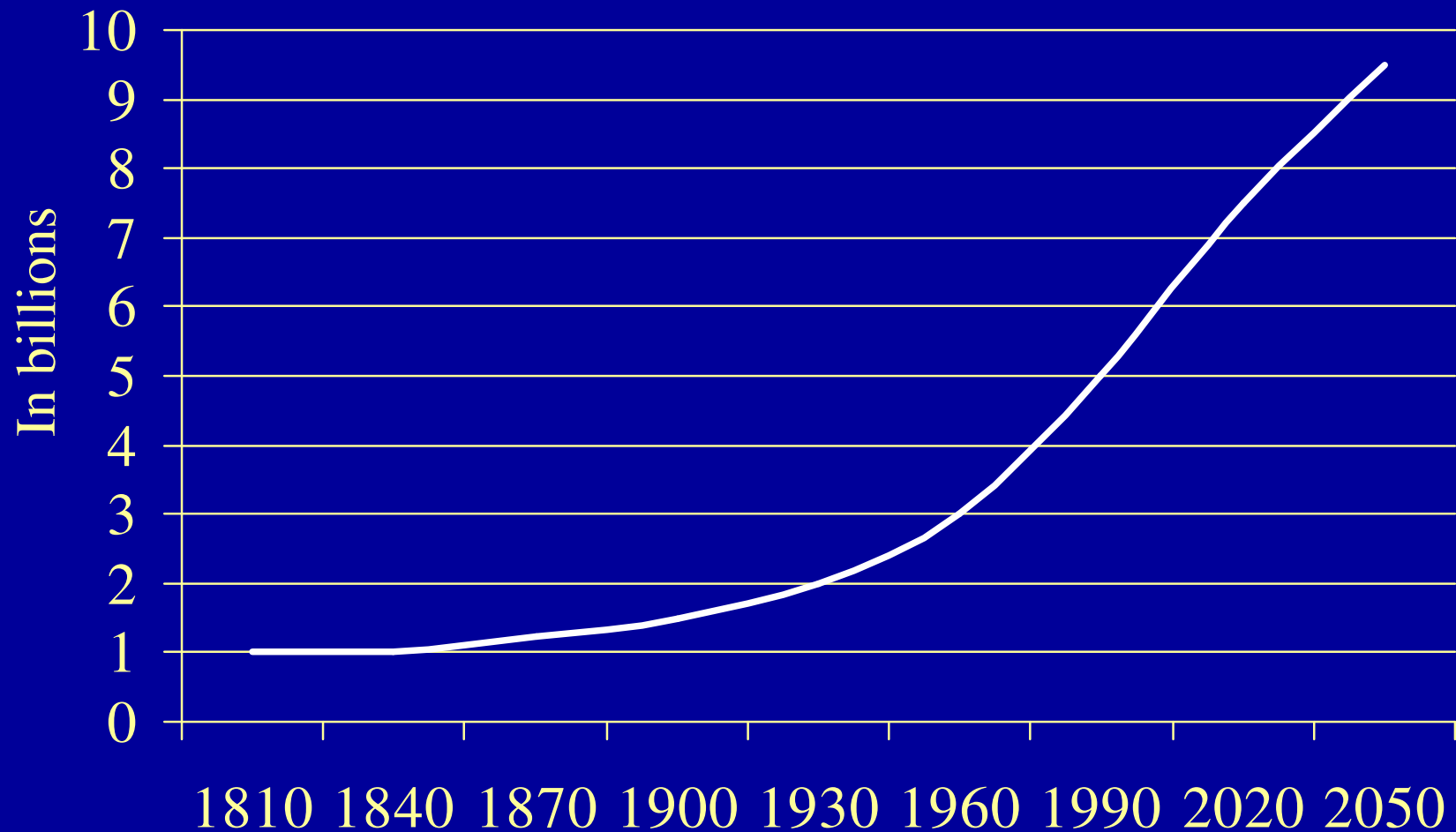
- People
- Senior citizens
- Vehicles
- Air traffic
- Mass transit demand
- Aging infrastructure

## Less...

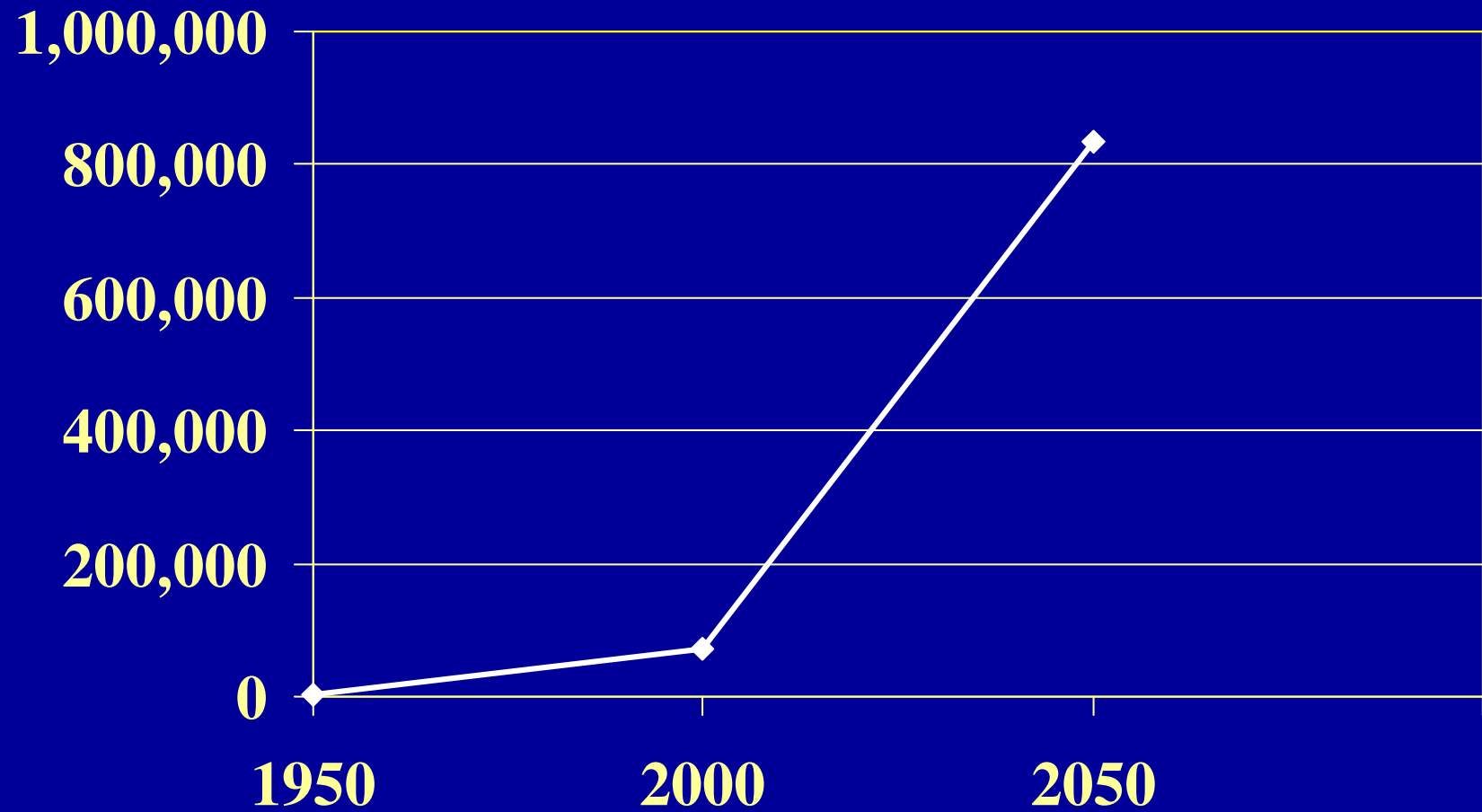
- Water supply
- Irrigated acreage
- Security
- Public confidence

## World Population

# Can We Absorb 4 Billion More?



# American Centenarians\*



\*Persons who are at least 100 years old.



The Rivers  
Are  
Running  
Dry



“The world has to significantly increase water production while at the same time restoring the world’s rivers if we are to have any hope of meeting the water needs of 8 billion people while protecting the environment.”

**Ismail Serageldin**  
**World Commission on Water for the 21st Century**

# Infrastructure Fails to Keep Up



One million Americans become sick every year from tainted drinking water, attributed in part to the role of decaying infrastructure in encouraging the growth of bacteria.

**Centers for Disease Control**



# Transportation Demands Speed Up





Boston's new Central Artery will tunnel underneath the city, then rise up to cross the Charles River on two bridges with a total of 14 lanes.

# Commercial Air Travel Takes Off





As highways  
and airports  
become more  
congested, the  
demand for  
mass transit is  
growing.





“There’s a new risk involved, not only the risk of terrorism directly, but the psychological risk among people who would use tall buildings.”

**Henry Petroski**  
**Civil Engineering Professor**  
**Duke University**

“More than any other time in history, mankind faces a crossroads: One path leads to despair and utter hopelessness. The other to total extinction. Let us pray we have the wisdom to choose correctly.”

Woody Allen  
*Side Effects*



Armed with the right talent  
and technology, we can  
build the safe harbor  
humankind needs in the face  
of our growing challenges.

# Technological Answers Looking For Construction Solutions



# Biotechnology

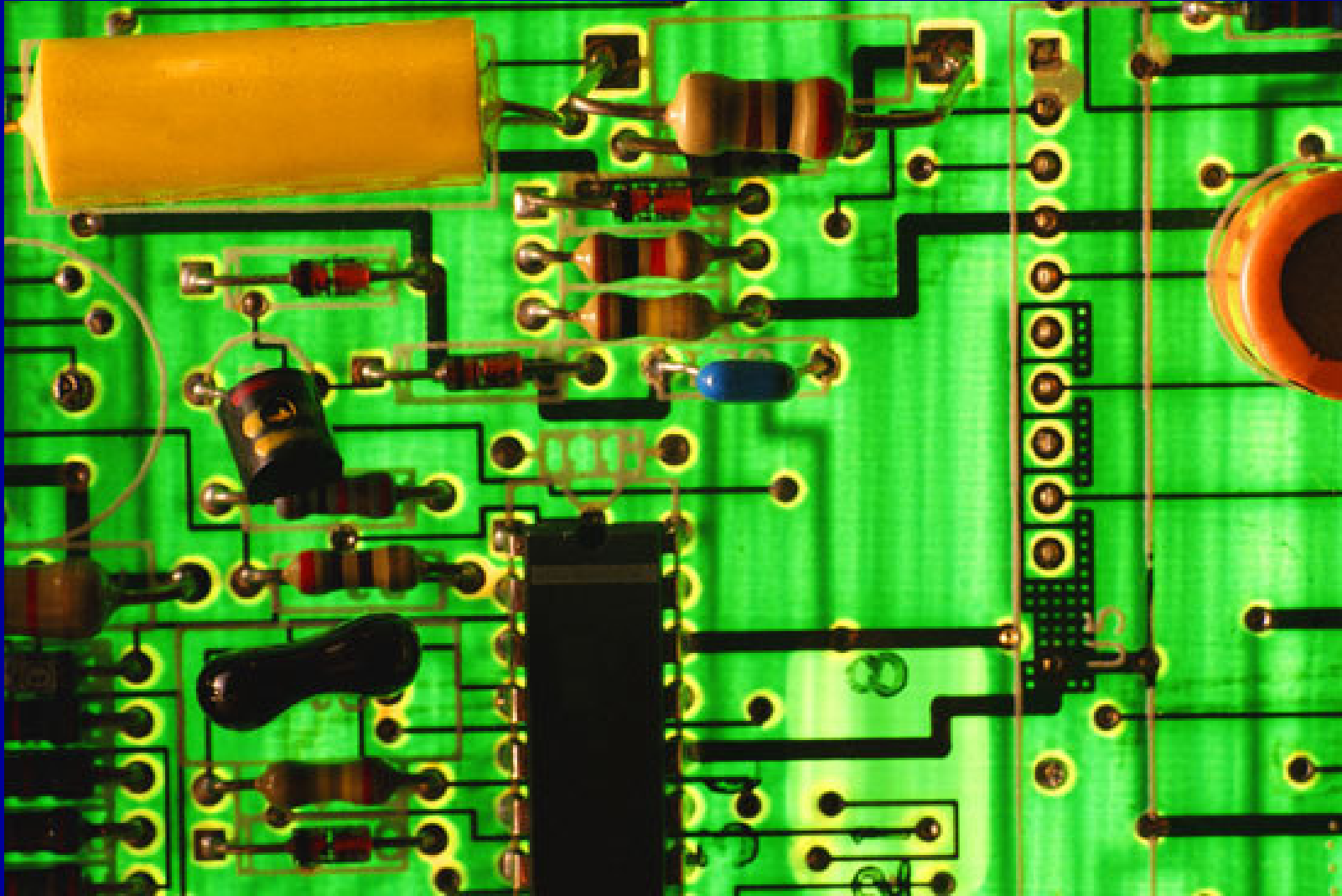


- Genetically engineered micro-organisms will be used in the manufacture of high-strength building materials.
- Biotechnology disposal will eliminate plumbing pipes for waste

**Randall Vosbeck**  
*Architectural Record*, Dec 1999



# Advanced Communications: Do We Get IT?



# Today's Structures: Intelligent as well as Good-Looking





## Intelligent Transportation:

Digital cameras survey highways, sending a constant flow of images to a computer that manages an intelligent transportation system.

Today: Virtual  
reality with  
headgear and  
tactile gloves



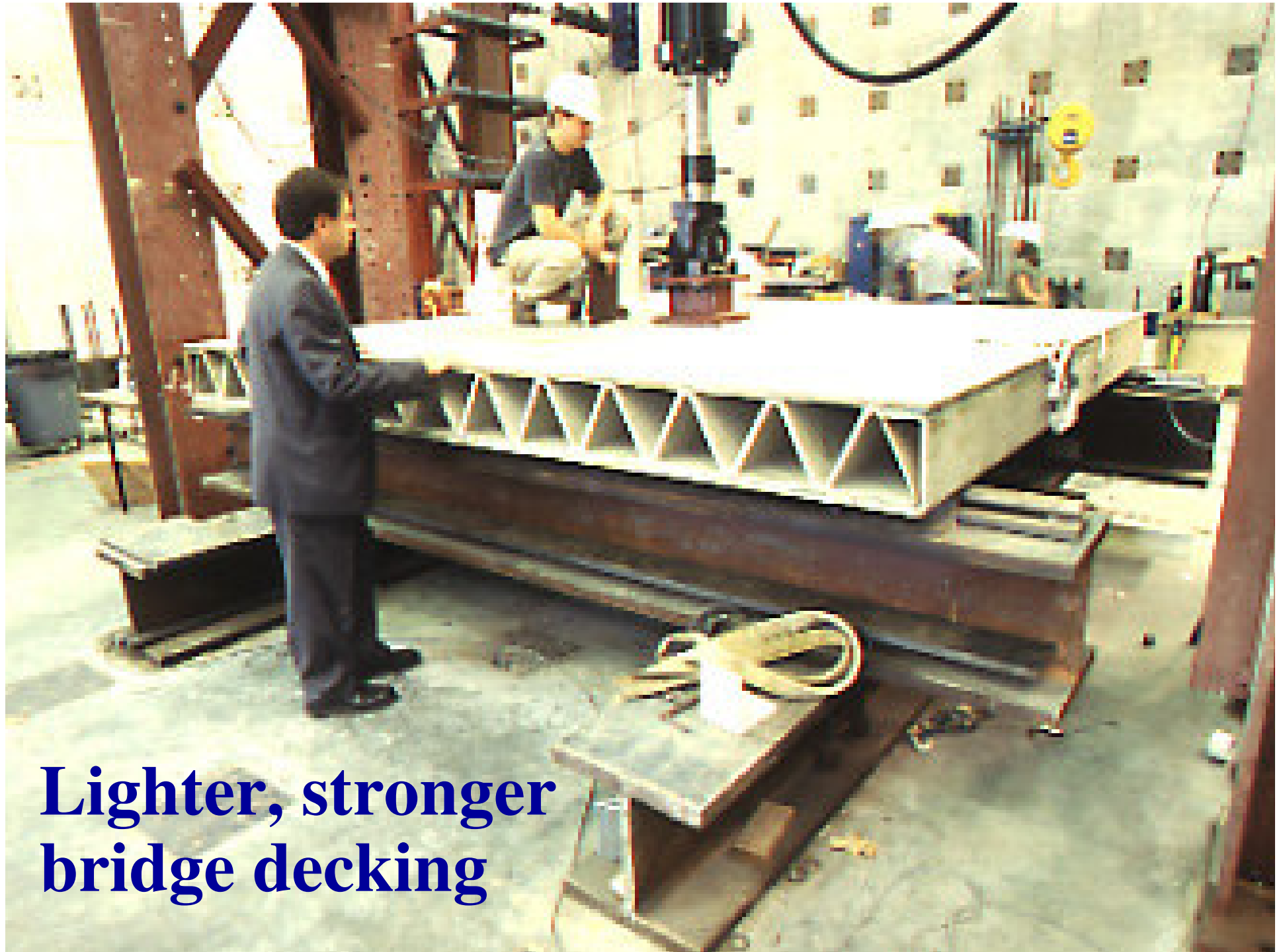


# Tomorrow: Virtual reality with neural implants



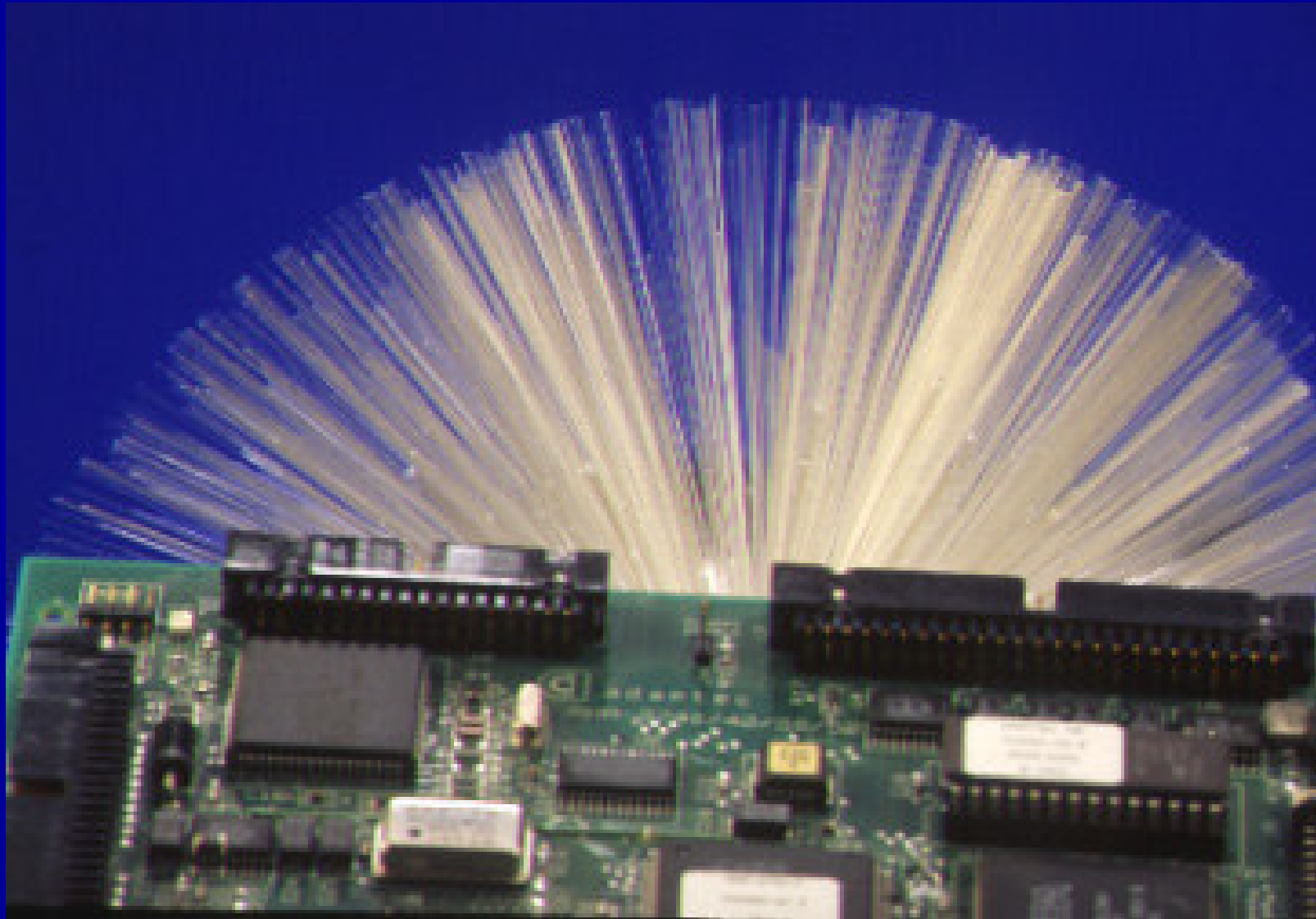
# Nanotechnology and New Materials





**Lighter, stronger  
bridge decking**

# Lacing Materials with Optical Sensors





**“Smart” bridges represent a new era in highway safety as well as construction.**



# New Management Strategies





# Streamlining the Construction Process

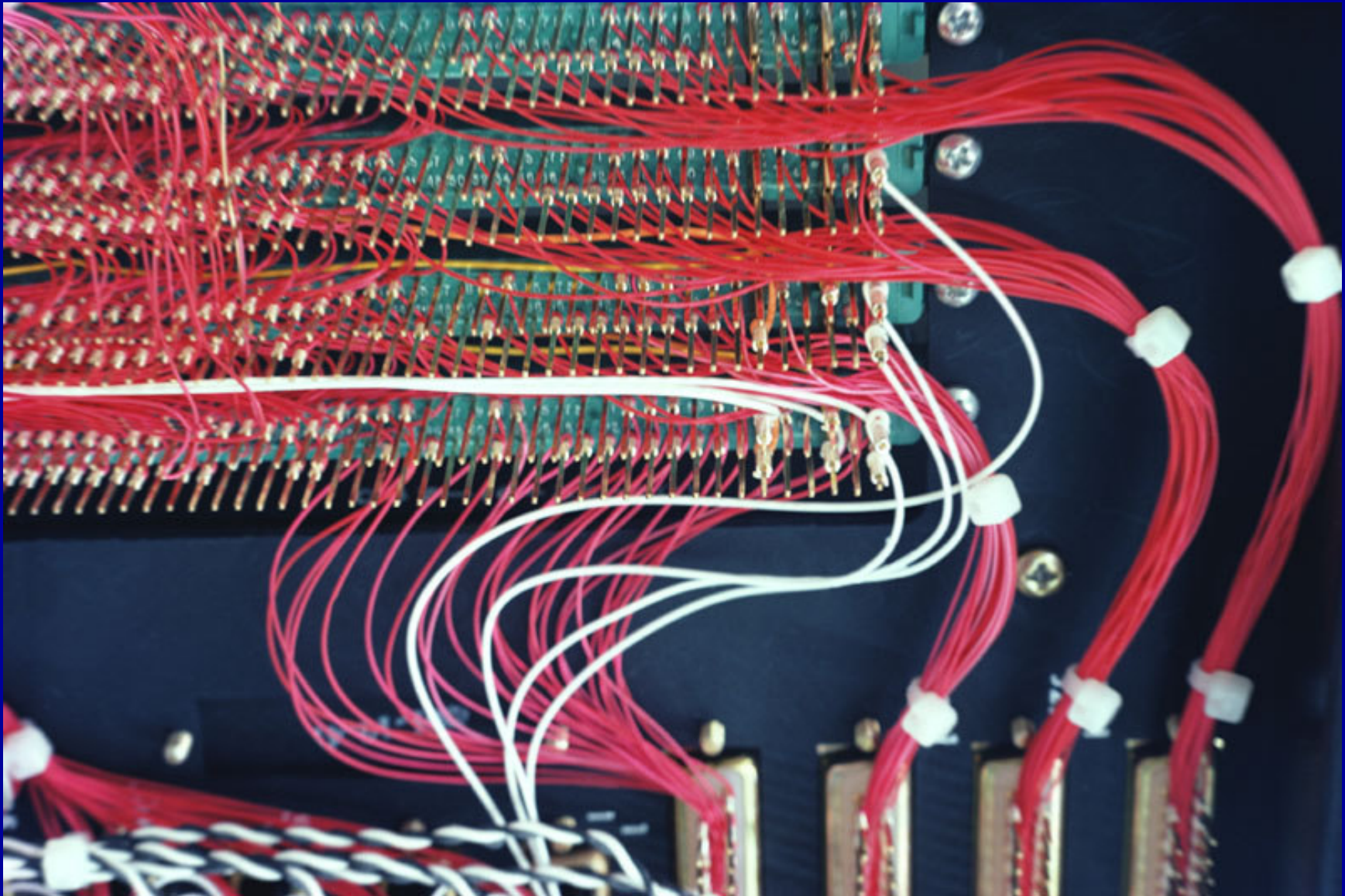




Design-build  
brings all parties  
together around a  
consensus vision  
for the project.



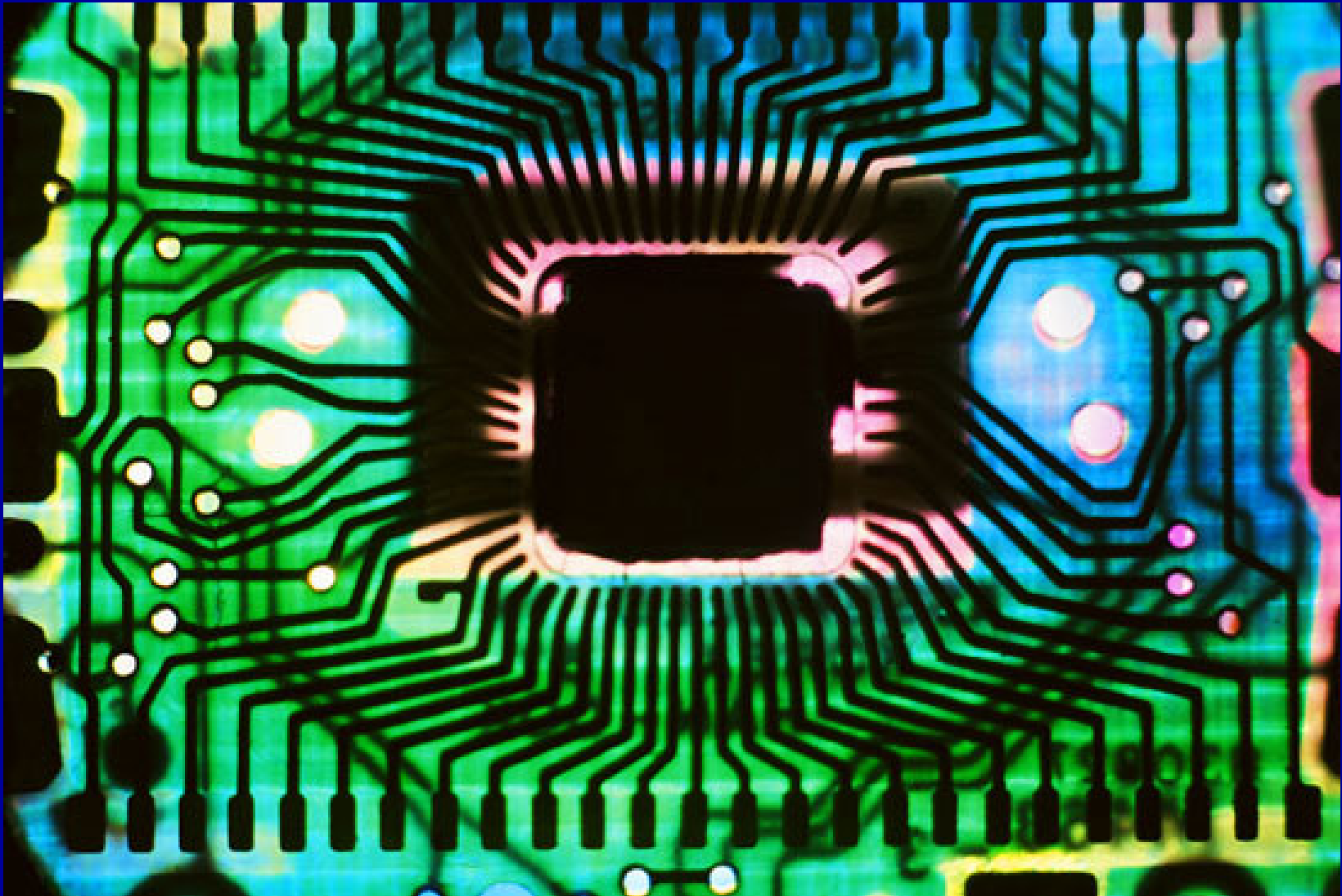
# Taking Business Online



“We set up websites for our projects that include change orders, schedules – which are so important in retail construction – and shop drawings, so we can get many sets of eyes on them.”

**Bill Pratt, Director of Business Operations  
Walbridge Aldinger, Tampa**

# System on a Chip





# Sustainability





“The construction industry worldwide is the largest exploiter of natural resources of any sector of the global economy, and a major generator of waste and pollution. Building accounts for one-third of the world’s wood harvest, two-fifths of its material and energy usage, and one-sixth of its fresh water withdrawals.”

**Mike Kelly**  
Building Design Expert  
Edinburgh, Scotland



“It isn’t easy  
being green.”

**Kermit the Frog**

# Making Skyscrapers Safer



# Educating a New Construction Manager for a New Millennium





“There isn’t an engineering school out there that isn’t looking at its curriculum.”

**Eleanor Baum, Dean  
Cooper Union School of Engineering**





Lifelong Learning Online



The point is to actually build something.

# Teaching the Practice of Engineering





“I look forward to an America...  
which will protect the beauty of  
our natural environment, which  
will preserve the great old  
American houses and squares and  
parks of our national past, and  
which will build handsome and  
balanced cities for our future.”

John F. Kennedy

The first step  
toward  
achievement  
is to  
acknowledge  
the challenge.

